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Attempt to Violate the CHSH Bell Inequality in Josephson Phase Qubits MARKUS ANSMANN, R. BIALCZAK, N. KATZ, E. LUCERO, R. MC-
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LAND, J.M. MARTINIS, UC Santa Barbara — The violation of Bell's inequality is the primary argument against the possible existence of a hidden-variable-theory as an alternative to quantum mechanics. It also often serves as a convincing demonstration that a given system behaves in a truly non-classical way. There have been many proposals of different classically binding inequalities that quantum mechanics can violate. The most widely accepted forms follow closely along a correlation measurement proposed by Clauser, Horne, Shimony and Holt (CHSH) in 1969. Here we present our attempt to implement the CHSH Bell test using Josephson phase qubits. The nature of this experiment places high demands – compared to the current state of the art in solid state qubits – on qubit performance measures such as the energy relaxation time T_1 , the decoherence time T_2 , measurement fidelities, and the quality of single and two qubit operations. We will examine these demands and position our past and current qubit designs against them.

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